20-1B12IPA015SC-L579F09
datasheet

Vincotech

*flow*IPM 1B — 1200 V / 15 A

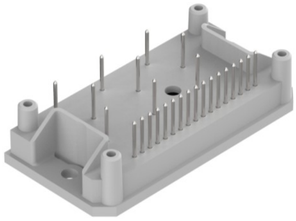
Features

Power
- Three Phase Inverter
- Emitter Shunts

Gate Driver
- Booststrap circuit
- Overcurrent protection
- Undervoltage lockout

NTC
- Temperature sensor

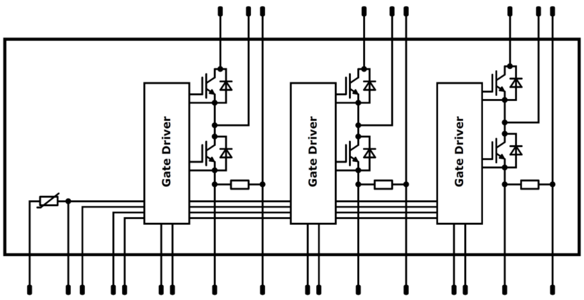
***flow*1B 17 mm housing**



Target applications

- Embedded Drives
- Industrial Drives

Schematic



Types

- 20-1B12IPA015SC-L579F09

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Inverter Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current	I_C	$T_j = T_{jmax}$ T_s = 80 °C	12	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	45	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	31	W
Gate-emitter voltage	V_{GES}		±20	V
Short circuit ratings	t_{SC}	V_{GE} = 15 V V_{cc} = 800 V T_j ≤ 150 °C	10	µs
Maximum junction temperature	T_{jmax}		175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Inverter Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	11	A
Repetitive peak forward current	I_{FRM}			30	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	19	W
Maximum junction temperature	T_{jmax}			175	°C
Gate Driver					
Supply voltage	V_{CC}			-0,5…+24	V
Logic input voltage	V_{in}	UH, UL, VH, VL, WH, WL, FO, RST		-0,5…V_{cc}+0,5	V
Internal current limit	I_{MAX}			16,7	A
Junction Temperature	T_{jmax}			125	°C
Inverter Shunt					
Max DC current	I_{MAX}		T_c = 25 °C	9	A
Power dissipation	P_{tot}		T_c = 105 °C	2,43	W
Module Properties					
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	°C
Operation temperature under switching condition	T_{jop}			-40…(T_{jmax} - 25)	°C
Isolation Properties					
Isolation voltage	V_{isol}	DC Test Voltage*	t_p = 2 s	6000	V
		AC Voltage	t_p = 1 min	2500	V
Creepage distance				min. 12,7	mm
Clearance				min. 12,7	mm
Comparative Tracking Index	CTI			> 200	

*100 % tested in production

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_{F} [V]	I_{C} [A] I_{D} [A] I_{F} [A]	T_{j} [°C]	Min	Typ	Max	
Inverter Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,0005	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}		15		12	25 125 150		2,10 2,28 2,46	2,3	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			10	µA
Gate-emitter leakage current	I_{GES}		20	0		25			120	nA
Internal gate resistance	r_{g}							none		Ω
Input capacitance	C_{ies}	f= 1 Mhz	0	25		25		890		pF
Reverse transfer capacitance	C_{res}							30		
Gate charge	Q_{g}		20			25		0,12		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						3,07		K/W
Dynamic										
Turn-on delay time*	$t_{d(on)}$	R_{gon} = 16 Ω R_{goff} = 32 Ω	0 / 15	600	11	25 125 150		1480 1912 2007		ns
Rise time	t_{r}					25 125 150		19 23 24		
Turn-off delay time*	$t_{d(off)}$					25 125 150		1508 2011 2119		
Fall time	t_{f}					25 125 150		79 133 159		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 1,2 µC Q_{rFWD} = 2,2 µC Q_{rFWD} = 2,6 µC				25 125 150		0,676 1,107 1,240		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,879 1,440 1,600		

* times include gate driver propagation delay

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Inverter Diode										
Static										
Forward voltage	V_F				12	25 125 150		1,93 1,91 1,90	2,3	V
Reverse leakage current	I_R			1200		25			3,5	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						4,92		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 730 A/µs di/dt = 539 A/µs di/dt = 478 A/µs	0 / 15	600	11	25 125 150		12 13 14		A
Reverse recovery time	t_{rr}					25 125 150		245 394 437		ns
Recovered charge	Q_r					25 125 150		1,226 2,228 2,557		µC
Reverse recovered energy	E_{rec}					25 125 150		0,453 0,829 0,965		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		80 42 39		A/µs

Characteristic Values

Parameter	Symbol	Conditions	V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	Unit
Gate Driver*										
Static										
Recommended supply voltage	V_{cc}						13,5	15	20	V
Power on reset trip voltage	V_{POR}						4,0	5,5	7,5	V
Internal current limit	I_{MAX}						13,3	16,7	20	A
Quiescent supply current	I_q							3	4,5	mA
Logic "1" input voltage	V_{IH}	UH, UL, VH, VL, WH, WL, RST					2,2	3	4	V
Logic "0" input voltage	V_{IL}	UH, UL, VH, VL, WH, WL, RST					0,6	1,5	2,1	V
Logic "1" input current	I_{inH}	V_{in} = 5 V					0,6	1	1,4	mA
Logic "0" input current	I_{inL}	V_{in} = 0 V					0	0	0,01	mA
Input signal filter time	t_{Filt}	UH, UL, VH, VL, WH, WL, FO (in), RST (pulse)					80	200	500	ns
Logic "1" FAULT output**	$V_{outFAULTH}$								0,95	V
Logic "1" FAULT input treshold voltage**	$V_{inFAULTH}$						0,6	1,5	2,1	V
Logic "0" FAULT input treshold voltage**	$V_{inFAULTL}$						2,2	3	4	V
Under voltage reset voltage	$V_{UVreset}$						10	10,8	11,6	V
Under voltage trip voltage	V_{UVtrip}						10,5	11,3	12,1	V
Under voltage hysteresis voltage	$V_{UVhysteresis}$						0,2	0,5	0,8	V
Under voltage filter time	t_{UVfilt}						4	8	16	µs
Internal dead time	t_{UVfilt}	Delay matching, high side turn-on and low side turn off					-100	80	300	ns
Internal dead time	t_{UVfilt}	Delay matching, low side turn-on and high side turn off					-20	180	400	ns

* For more information see Mitshubishi's M81738FP datasheet. The recommended minimum input pulse width is 2.12 µs.
** FAULT active low with pull up resistor to Vcc.

Parameter	Symbol	Conditions	V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	Unit
Inverter Shunt										
Resistance	R							30		mΩ

Characteristic Values

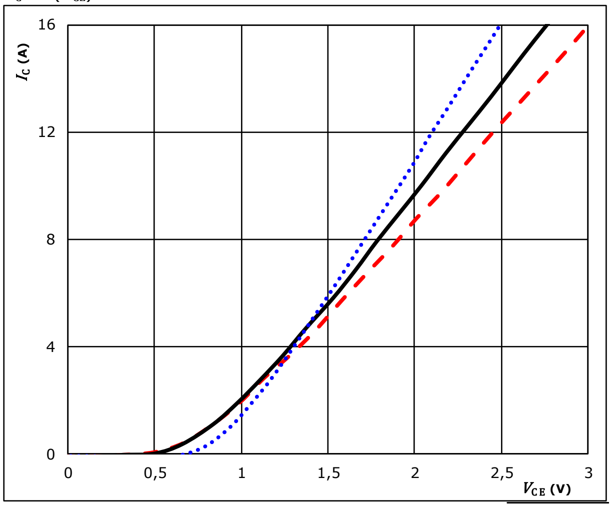
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Thermistor										
Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1486 Ω				100	-12		+14	%
Power dissipation	P					25		200		mW
Power dissipation constant						25		2		mW/K
B-value	$B_{(25/50)}$	Tol. ±3%				25		3950		K
B-value	$B_{(25/100)}$	Tol. ±3%				25		3998		K
Vincotech NTC Reference									B	

Inverter Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

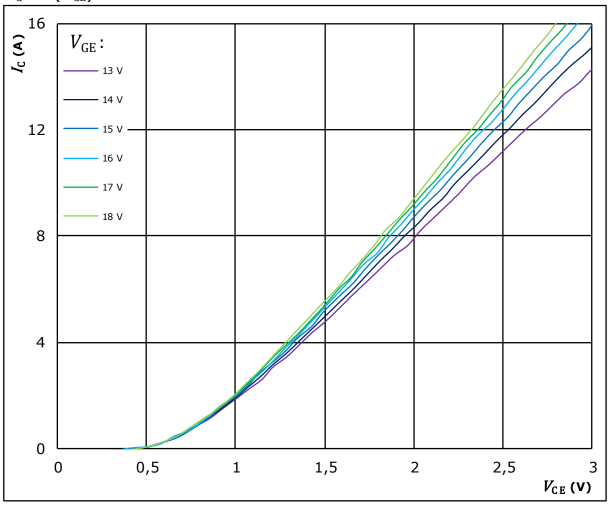


t_p =	250	μs		25 °C	
V_{GE} =	15	V	T_j:	125 °C	
				150 °C	

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

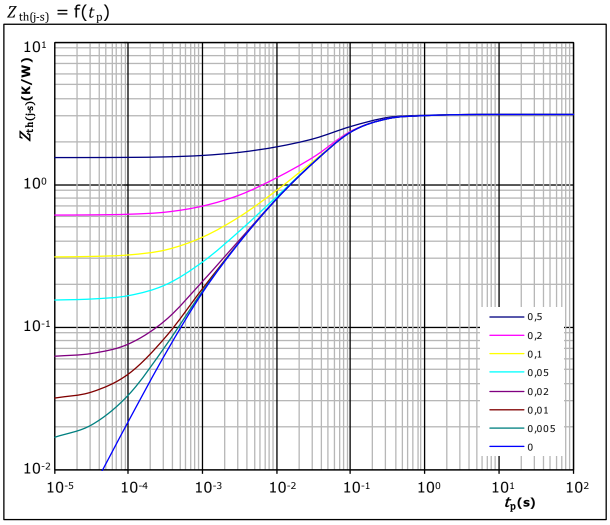


t_p =	250	μs
T_j =	150	°C
V_{GE} from	13 V to 18 V in steps of 1 V	

figure 3. **IGBT**

Transient thermal impedance as function of pulse duration

$Z_{th(j-s)} = f(t_p)$



D = t_p / T

$R_{th(j-s)}$ = 3,07 K/W

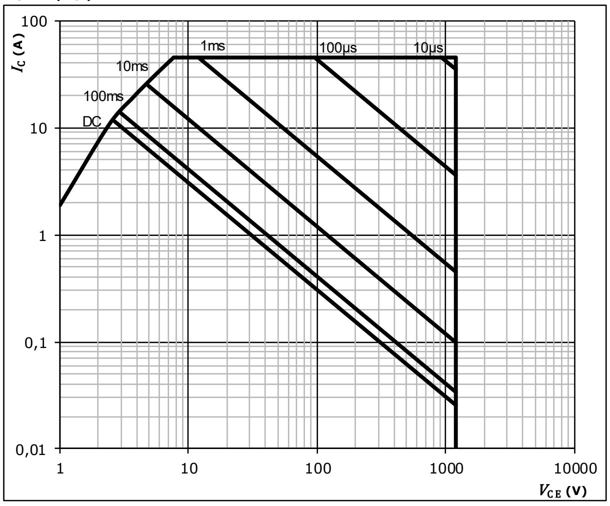
IGBT thermal model values

R (K/W)	τ (s)
1,26E-01	1,14E+00
4,34E-01	2,04E-01
1,94E+00	6,00E-02
4,50E-01	6,48E-03
1,19E-01	9,59E-04

figure 4. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



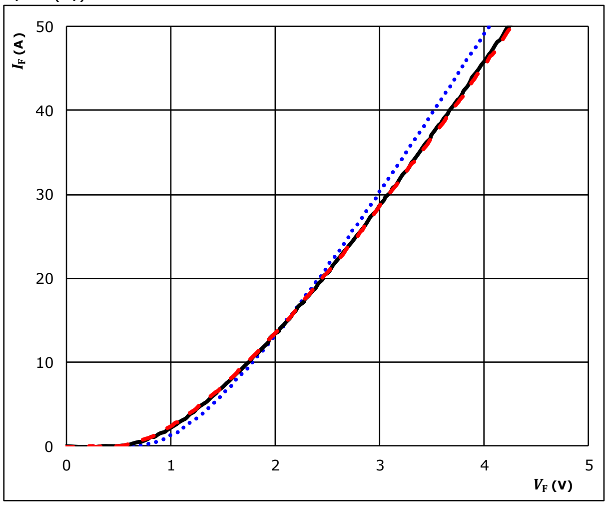
D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	

Inverter Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



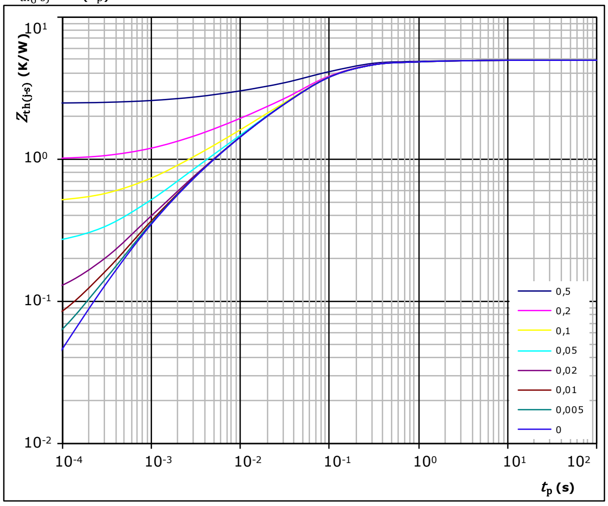
t_p = 250 µs

T_j: 25 °C · 125 °C · 150 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

$Z_{th(j-s)} = f(t_p)$



$D = t_p / T$

$R_{th(j-s)}$ = 4,92 K/W

FWD thermal model values

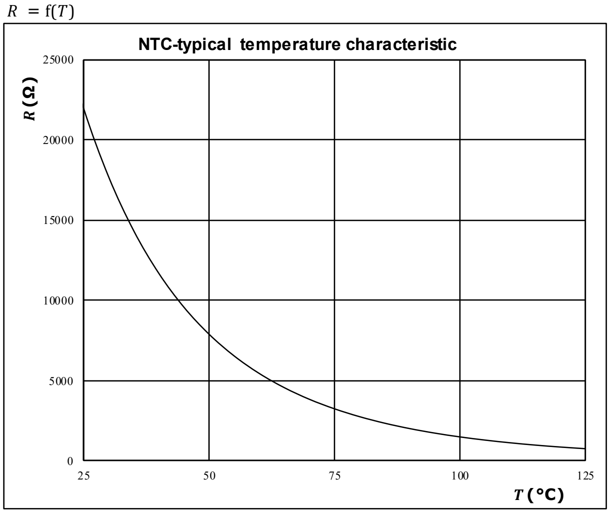
R (K/W)	τ (s)
1,83E-01	2,10E+00
4,86E-01	2,84E-01
2,86E+00	6,82E-02
7,18E-01	1,40E-02
5,14E-01	3,30E-03
1,52E-01	6,79E-04

Thermistor Characteristics

figure 1. **Thermistor**

Typical NTC characteristic
as a function of temperature

$R = f(T)$

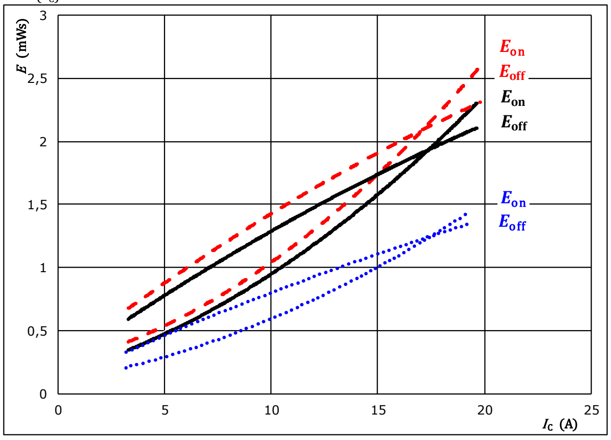


Inverter Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



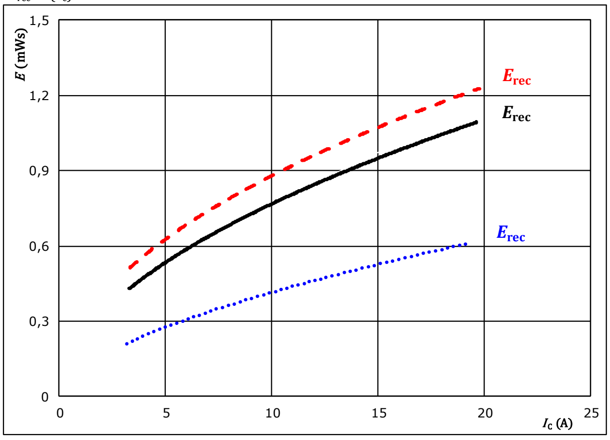
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	0 / 15	V		125 °C
R_{gon} =	16	Ω		150 °C
R_{goff} =	32	Ω		

figure 2. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



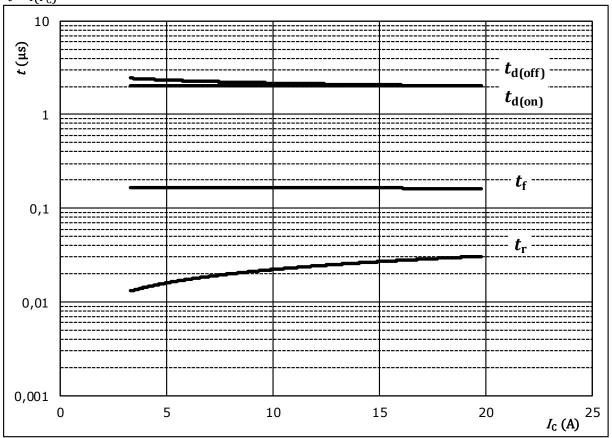
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	0 / 15	V		125 °C
R_{gon} =	16	Ω		150 °C

figure 3. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



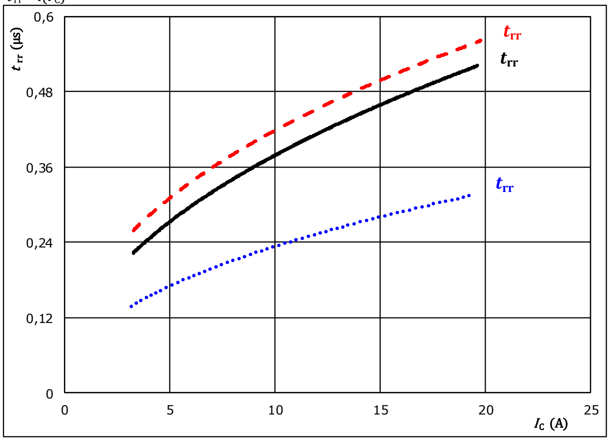
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	0 / 15	V
R_{gon} =	16	Ω
R_{goff} =	32	Ω

figure 4. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



At					
	V_{CE}=	600	V	T_j:	25 °C
	V_{GE} =	0 / 15	V		125 °C
	R_{gon} =	16	Ω		150 °C

Vincotech

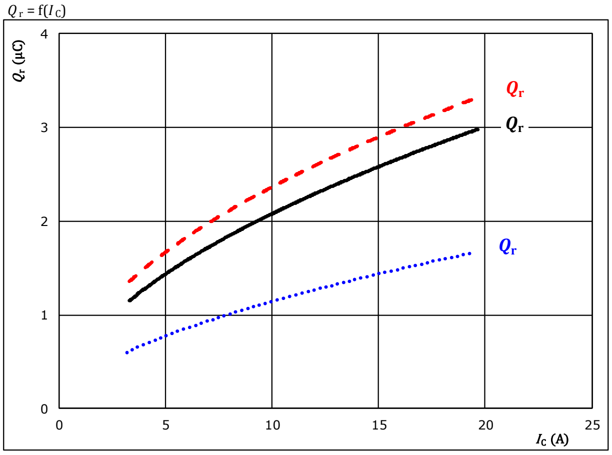
20-1B12IPA015SC-L579F09
datasheet

Inverter Switching Characteristics

figure 5. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

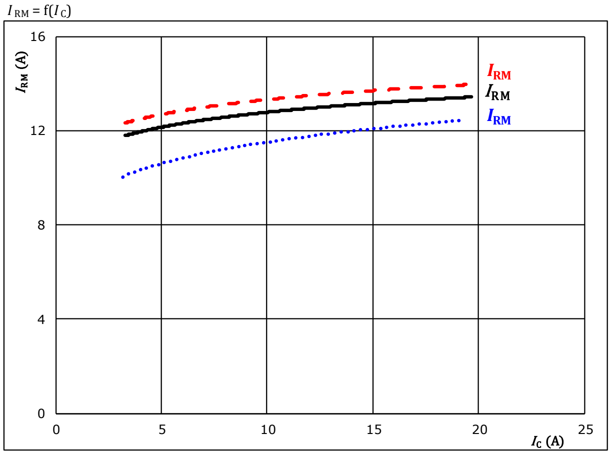


At
V_{CE} = 600 V
V_{GE} = 0 / 15 V
R_{gon} = 16 Ω
T_j: 25 °C (dotted), 125 °C (solid), 150 °C (dashed)

figure 6. **FWD**

Typical peak reverse recovery current current as a function of collector current

$I_{RM} = f(I_C)$

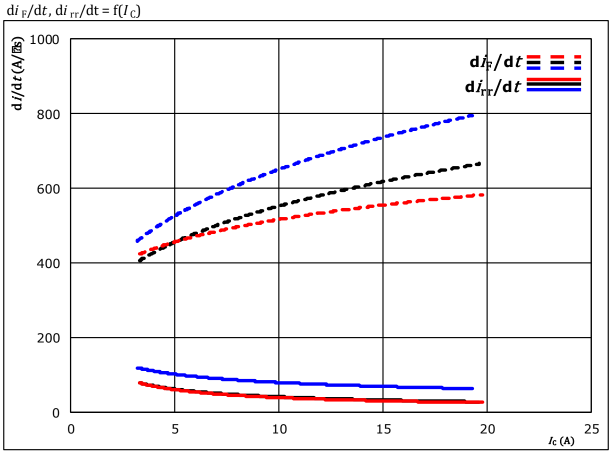


At
V_{CE} = 600 V
V_{GE} = 0 / 15 V
R_{gon} = 16 Ω
T_j: 25 °C (dotted), 125 °C (solid), 150 °C (dashed)

figure 7. **FWD**

Typical rate of fall of forward and reverse recovery current as a function of collector current

$di_F/dt, di_{rr}/dt = f(I_C)$

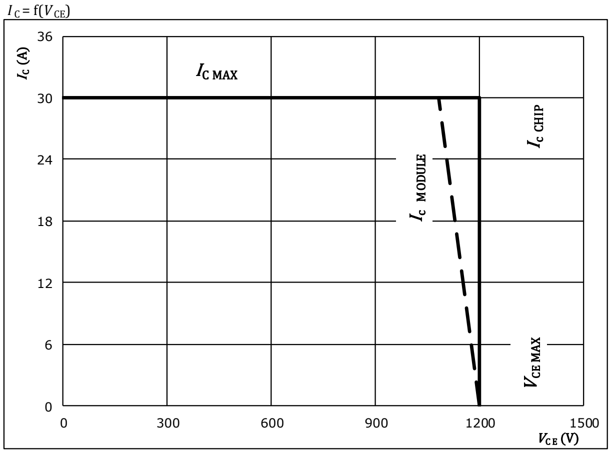


At
V_{CE} = 600 V
V_{GE} = 0 / 15 V
R_{gon} = 16 Ω
T_j: 25 °C (dotted), 125 °C (solid), 150 °C (dashed)

figure 7. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At
T_j = 175 °C
R_{gon} = 16 Ω
R_{goff} = 32 Ω

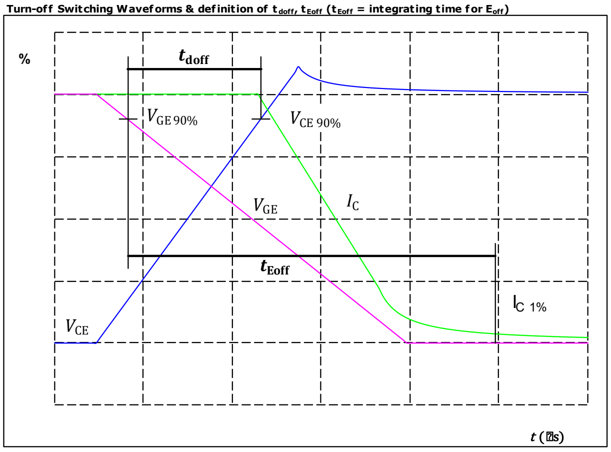
Inverter Switching Definitions

General conditions

T_j	=	125 °C
R_{gon}	=	16 Ω
R_{goff}	=	32 Ω

figure 1. **IGBT**

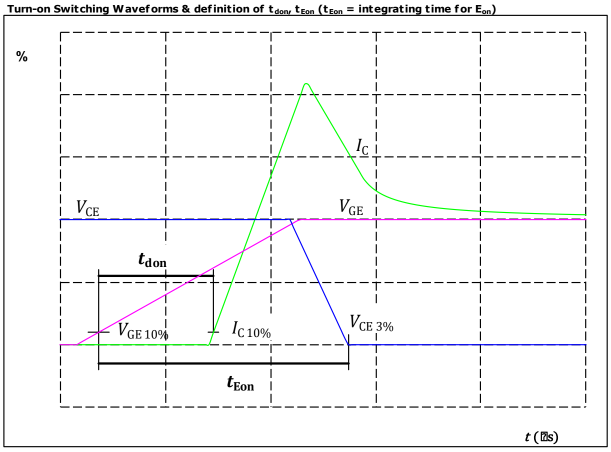
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%)$ =	0	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	11	A
t_{doff} =	2011	ns

figure 2. **IGBT**

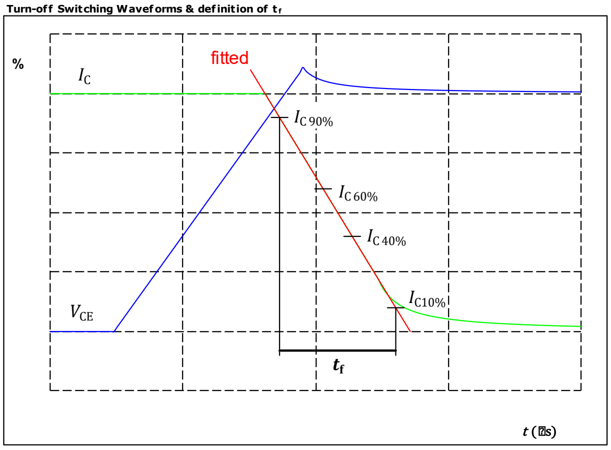
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%)$ =	0	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	11	A
t_{don} =	1912	ns

figure 3. **IGBT**

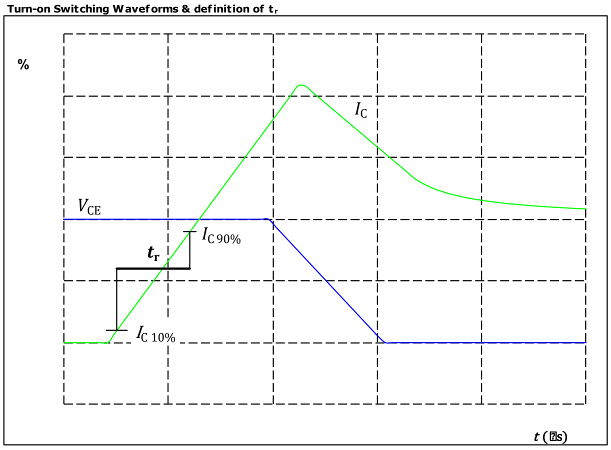
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	11	A
t_f =	133	ns

figure 4. **IGBT**

Turn-on Switching Waveforms & definition of t_r

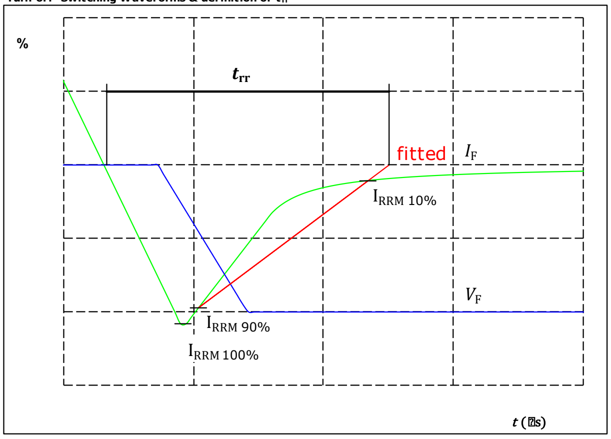


$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	11	A
t_r =	23	ns

Inverter Switching Characteristics

figure 5.	FWD

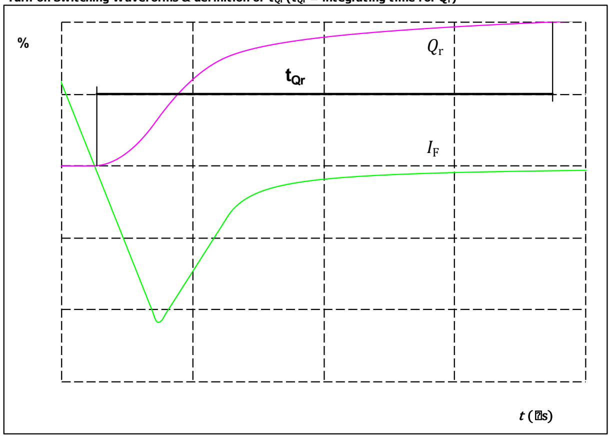
Turn-off Switching Waveforms & definition of t_{rr}



V_F (100%) =	600	V
I_F (100%) =	11	A
I_{RRM} (100%) =	13	A
t_{rr} =	394	ns

figure 6.	FWD

Turn-on Switching Waveforms & definition of t_{Qr} (t_{Qr} = integrating time for Q_r)



I_F (100%) =	11	A
Q_r (100%) =	2,23	μC

Vincotech

20-1B12IPA015SC-L579F09
datasheet

Ordering Code & Marking

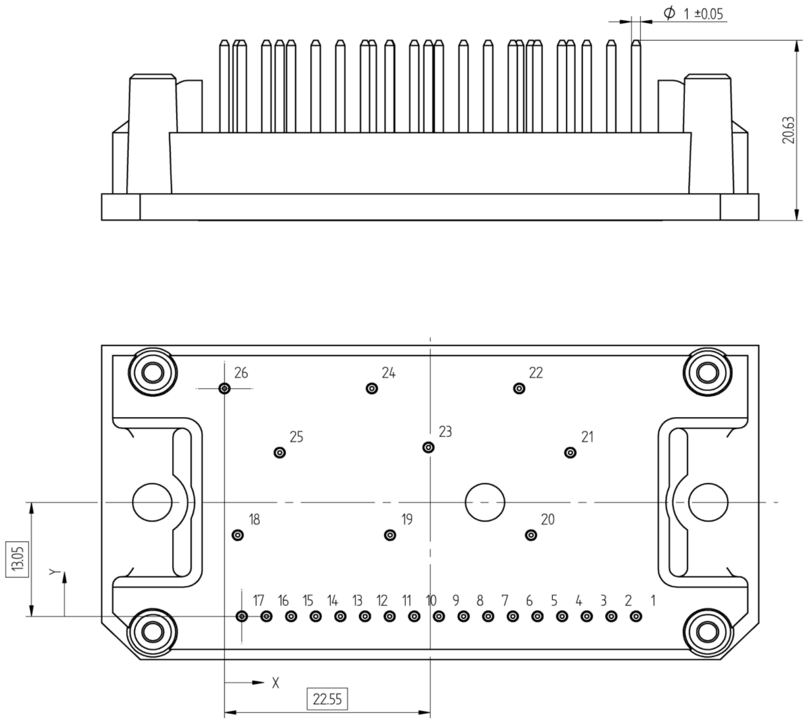
Version	Ordering Code
without thermal paste 17 mm housing with solder pins	20-1B12IPA015SC-L579F09
with thermal paste 17 mm housing with solder pins	20-1B12IPA015SC-L579F09-/3/

	Name		Date code	UL & VIN	Lot	Serial
Text	NN-NNNNNNNNNNNNNN-TTTTTTVV		WWYY	UL VIN	LLLLL	SSSS
	Type&Ver	**Lot number**	**Serial**	**Date code**		
Datamatrix	TTTTTTTVV	LLLLL	SSSS	WWYY		

Outline

Pin table

Pin	X	Y	Function
1	45,1	0	WH
2	42,4	0	WL
3	39,7	0	RW+
4	37	0	RW-
5	34,3	0	GND
6	31,6	0	VCC
7	28,9	0	VH
8	26,2	0	VL
9	23,5	0	RV+
10	20,8	0	RV-
11	18,1	0	RST
12	15,4	0	FO
13	12,7	0	UH
14	10	0	UL
15	7,3	0	RU+
16	4,6	0	RU-
17	1,9	0	THERM1
18	1,45	9,3	EU
19	18,15	9,3	EV
20	33,6	9,3	EW
21	37,9	18,75	DC+3
22	32,3	26,1	W
23	22,35	19,35	DC+2
24	16,15	26,1	V
25	6,05	18,75	DC+1
26	0	26,1	U



Tolerance of pinpositions: ±0.5mm at the end of pins
Dimension of coordinate axis is only offset without tolerance

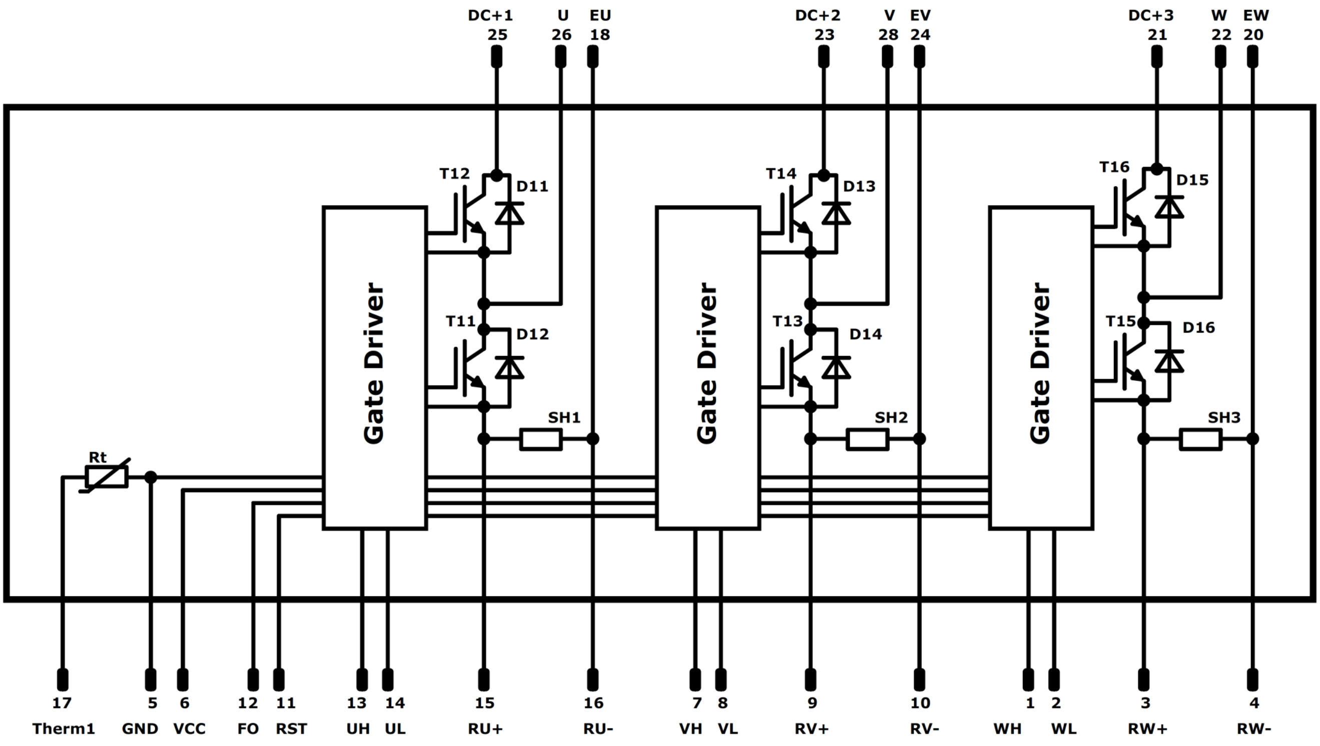
Pin Descriptions

Pin	Function	Description
1	WH	Signal input for high-side W phase
2	WL	Signal input for low-side W phase
3	RW+	W phase shunt +
4	RW-	W phase shunt -
5	GND	Signal ground
6	VCC	Driver circuit supply voltage
7	VH	Signal input for high-side V phase
8	VL	Signal input for low-side V phase
9	RV+	V phase shunt +
10	RV-	V phase shunt -
11	RST	Fault latch reset (min. 500ns pulse)
12	FO	Fault latch input/output (negative logic, open drain)
13	UH	Signal input for high-side U phase
14	UL	Signal input for low-side U phase
15	RU+	U phase shunt +
16	RU-	U phase shunt -
17	THERM1	Temperature sensor connector

Power pin descriptions

Pin	Function	Description
18	EU	Open emitter U phase
19	EV	Open emitter V phase
20	EW	Open emitter W phase
21	DC+3	Inverter input DC+
22	W	Output W phase
23	DC+2	Inverter input DC+
24	V	Output V phase
25	DC+1	Inverter input DC+
26	U	Output U phase

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T11, T12, T13, T14, T15, T16	IGBT	1200 V	12 A	Inverter Switch	
D11, D12, D13, D14, D15, D16	FWD	1200 V	12 A	Inverter Diode	
SH1, SH2, SH3	Shunt		9 A	Inverter Shunt	
Rt	NTC			Thermistor	

Packaging instruction				
Standard packaging quantity (SPQ) 100	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* 1B packages see vincotech.com website.

Package data
Package data for *flow* 1B packages see vincotech.com website.

UL recognition and file number
This device is certified according to UL 1557 standard, UL file number E192116. For more information see vincotech.com website.

Document No.:	Date:	Modification:	Pages
20-1B12IPA015SC-L579F09-D3-14	26 July. 2019	Modified remark on Gate Driver, $V_{outFAULTH}$ condition	5

DISCLAIMER

The information, specifications, procedures, methods and recommendations herein (together "information") are presented by Vincotech to reader in good faith, are believed to be accurate and reliable, but may well be incomplete and/or not applicable to all conditions or situations that may exist or occur. Vincotech reserves the right to make any changes without further notice to any products to improve reliability, function or design. No representation, guarantee or warranty is made to reader as to the accuracy, reliability or completeness of said information or that the application or use of any of the same will avoid hazards, accidents, losses, damages or injury of any kind to persons or property or that the same will not infringe third parties rights or give desired results. It is reader's sole responsibility to test and determine the suitability of the information and the product for reader's intended use.

LIFE SUPPORT POLICY

Vincotech products are not authorised for use as critical components in life support devices or systems without the express written approval of Vincotech.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in labelling can be reasonably expected to result in significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.